

Water - Thermal Properties

Thermal properties of water - density, freezing temperature, boiling temperature, latent heat of melting, latent heat of evaporation, critical temperature and more

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Thermal properties for water:

- Maximum density at 4 °C - 1000 kg/m<sup>3</sup>, 1.940 *slugs*/ft<sup>3</sup>
- [Specific Weight](#) at 4 °C - 9.807 kN/m<sup>3</sup>, 62.43 Lbs./Cu.Ft, 8.33 Lbs./Gal., 0.1337 Cu.Ft./Gal.
- Freezing temperature - 0 °C (Official [Ice](#) at 0 °C)
- [Boiling temperature](#) - 100 °C
- Latent heat of melting - 334 kJ/kg
- Latent heat of evaporation - 2257 kJ/kg
- Critical temperature - 380 °C - 386 °C
- Critical pressure - 221.2 bar, 22.1 MPa (MN/m<sup>2</sup>)
- Specific heat water - 4.187 kJ/kgK
- Specific heat ice - 2.108 kJ/kgK
- Specific heat water vapor - 1.996 kJ/kgK
- Thermal expansion from 4 °C to 100 °C - 4.2x10<sup>-2</sup> (Note! - [volumetric temperature expansion of water](#) is not linear with temperature)
- [Bulk modulus elasticity](#) - 2.15 x 10<sup>9</sup> (Pa, N/m<sup>2</sup>)

<a href="#">Temperature</a> - t -	<a href="#">Absolute pressure</a> - p -	<a href="#">Density</a> - ρ -	<a href="#">Specific volume</a> - v -	<a href="#">Specific Heat</a> - c <sub>p</sub> -	<a href="#">Specific entropy</a> - e -
(°C)	(kN/m <sup>2</sup> )	(kg/m <sup>3</sup> )	10 <sup>-3</sup> (m <sup>3</sup> /kg)	(kJ/(kg K))	(kJ/(kg K))
0 (Ice)		916.8			
0.01	0.6	999.8	1.00	4.217	0
4 (maximum density)	0.9	1000.0		4.205	
5	0.9	1000.0	1.00	4.202	0.075
10	1.2	999.8	1.00	4.192	0.150
15	1.7	999.2	1.00	4.1855 <sup>1)</sup>	0.223
20	2.3	998.3	1.00	4.182	0.296
25	3.2	997.1	1.00	4.180	0.367
30	4.3	995.7	1.00	4.178	0.438
35	5.6	994.1	1.01	4.178	0.505
40	7.7	992.3	1.01	4.179	0.581
45	9.6	990.2	1.01	4.181	0.637
50	12.5	988	1.01	4.182	0.707
55	15.7	986	1.01	4.183	0.767
60	20.0	983	1.02	4.185	0.832
65	25.0	980	1.02	4.188	0.893
70	31.3	978	1.02	4.191	0.966
75	38.6	975	1.03	4.194	1.016
80	47.5	972	1.03	4.198	1.076
85	57.8	968	1.03	4.203	1.134
90	70.0	965	1.04	4.208	1.192
95	84.5	962	1.04	4.213	1.250
100	101.33	958	1.04	4.219	1.307
105	121	954	1.05	4.226	1.382
110	143	951	1.05	4.233	1.418
115	169	947	1.06	4.240	1.473
120	199	943	1.06	4.248	1.527
125	228	939	1.06	4.26	1.565
130	270	935	1.07	4.27	1.635
135	313	931	1.07	4.28	1.687
140	361	926	1.08	4.29	1.739
145	416	922	1.08	4.30	1.790
150	477	918	1.09	4.32	1.842
155	543	912	1.10	4.34	1.892
160	618	907	1.10	4.35	1.942
165	701	902	1.11	4.36	1.992
170	792	897	1.11	4.38	2.041
175	890	893	1.12	4.39	2.090
180	1000	887	1.13	4.42	2.138
185	1120	882	1.13	4.45	2.187
190	1260	876	1.14	4.46	2.236
195	1400	870	1.15		2.282
200	1550	864	1.16	4.51	2.329
220		840		4.63	
225	2550	834	1.20	4.65	2.569
240		814		4.78	
250	3990	799	1.25	4.87	2.797
260		784		4.98	
275	5950	756	1.32	5.20	3.022
300	8600	714	1.40	5.65	3.256
325	12130	654	1.53	6.86	3.501
350	16540	575	1.74	10.1	3.781
360	18680	528	1.90	14.6	3.921

<sup>1)</sup> The International Committee for Weights and Measures, Paris, 1950, accepted W. J. de Haas's recommended value of 4.1855 J/g°C for the specific heat of water at 15 °C.

- 1 kg/m<sup>3</sup> = 0.001 g/cm<sup>3</sup> = 0.0005780 oz/in<sup>3</sup> = 0.16036 oz/gal (Imperial) = 0.1335 oz/gal (U.S.) = 0.0624 lb/ft<sup>3</sup> = 0.000036127 lb/in<sup>3</sup> = 1.6856 lb/yd<sup>3</sup> = 0.010022 lb/gal (Imperial) = 0.008345 lb/gal (U.S.) = 0.0007525 ton/yd<sup>3</sup>
- 1 N/m<sup>2</sup> = 1 Pa = 1.4504x10<sup>-4</sup> lb/in<sup>2</sup> = 1x10<sup>-5</sup> bar = 4.03x10<sup>-3</sup> in water = 0.336x10<sup>-3</sup> ft water = 0.1024 mm water = 0.295x10<sup>-3</sup> in mercury = 7.55x10<sup>-3</sup> mm mercury = 0.1024 kg/m<sup>2</sup> = 0.993x10<sup>-5</sup> atm
- 1 m<sup>3</sup>/kg = 16.02 ft<sup>3</sup>/lb<sub>m</sub> = 27680 in<sup>3</sup>/lb<sub>m</sub> = 119.8 US gal/lb<sub>m</sub> = 1000 liter/kg
- 1 kJ/(kg K) = 0.2389 kcal/(kg °C) = 0.2389 Btu/(lb<sub>m</sub> °F)